Field Sampling Plan

Produced by the Mojave Water Agency
Water Resources Department
December 2003
(**Revised 2008**)

The procedures discussed in this plan are based on industry standard methods, procedures, principles and practices regarding groundwater monitoring and water sample collection and analyses. This plan represents the Mojave Water Agency, Water Resources Department current understanding and interpretation of regulatory agency regulations, guidelines and policies. No further warranties are implied or made. This plan is for the sole purpose and use of the Mojave Water Agency groundwater monitoring and water quality sampling activities.

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1.0 INTRODUCTION

1.1 PURPOSE AND USE OF THIS PLAN

The purpose of this *Field Sampling Plan* is to provide Mojave Water Agency (MWA) personnel with consistent methods and techniques to be used to monitor and sample groundwater wells. This plan establishes MWA approved methods to consistently collect quality, representative groundwater samples and well measurements. Any deviations from this manual must be approved by the Agency Hydrogeologist and clearly documented along with reasons for the deviations.

2.0 WATER LEVEL MEASURING PROCEDURES FOR MONITORING WELLS

2.1 MEASURING STATIC WATER LEVELS

Static water levels will be measured during well runs on a monthly, semi-annual and annual basis. Water levels will be recorded on Subarea specific Water Level Data Sheets included in Appendix C.

Upon arrival at the well site, field personnel will inspect the wellhead and surface completion of the well. This process will be documented on a *Monitoring Well Surface Completion Inspection Form* (Appendix B). If it is discovered that the well head and/or measuring point has been damaged since the last round of well runs, record the damage information on a *Monitoring Well Surface Completion Inspection Form* and document with pictures. Record the depth to water from an alternate reference point, document the alternate reference point used for the water level measurement and notify the Agency Hydrogeologist.

If the well is completed as a nested or cluster well, the static water level in each casing should be measured before purging or sampling activities are implemented. An effort will be made to collect water level measurements from all monitored wells within a relatively short time in order to compile the water level data into a seasonal groundwater database.

The water level measurements will be read to the nearest 0.01 foot from a permanently-marked measuring point on the well (e.g., top of casing or reference elevation). When possible, one measuring device will be used for all site wells. If using more than one measuring instrument, the calibration of both instruments will be checked against the same well to ensure that they provide the same water level measurements. If the well is sealed with an airtight cap, the water level in the well will be allowed to equilibrate by removing the cap and exposing the well to the atmosphere. This may be especially important for wells screened in silt or clay (low permeability) formations. Several measurements may be needed to ensure that the water level has stabilized.

Monitoring and sampling records from previous sampling events will be brought into the field and compared with field measurements in order to assist in minimizing human error or to determine, in the field, if well conditions have changed.

Electronic Water Level Indicator

1. The water level meter probe will be decontaminated prior to use at each well. Decontamination procedures are described in Section 2.2.
2. The decontaminated probe or electrode will be lowered into the well until the instrument indicates that the water column has been reached.
3. The probe or electrode will be slowly raised and lowered in and out of the water column until the technician is satisfied that the instrument is providing a reliable water level reading. If necessary, the instrument's sensitivity will be adjusted according to the manufacturer's instructions.
4. The measurement on the cable or tape will be read to the nearest 0.01 foot against the top of casing or reference elevation on the well. This measurement will be recorded as "depth to water" at the measuring point.

Steel Tape

1. The steel tape will be decontaminated prior to use at each well. Decontamination procedures are described in Section 2.2.
2. Carpenters chalk will be applied to the bottom ten feet of the steel tape.
3. From a well measurement reference point (e.g. top of casing) the steel tape will be lowered approximately three feet below the previously recorded groundwater depth and the tape reading at the top of the well measurement reference point will be recorded. The tape will be retracted from the well casing and the depth to water will be calculated by subtracting the length of the wetted portion of the tape from the tape reading at the top of the well measurement reference point.
3. Steps 1 and 2 will be repeated until two successive water level measurements within 0.01 foot of each other are achieved, this depth will be recorded as "depth to water". Multiple measurements may be necessary.

Note: Condensation on the well's casing wall may wet the steel tape as it is lowered, thus causing measurement errors. In addition, if the approximate depth to water is unknown, an estimation of depth to water based on information from driller's logs or neighboring wells will be used to assume an initial depth to water and steps 1 and 2 will be repeated until a depth to water is determined.

Alternative Methods

Alternative water level measuring devices or methods are acceptable if they (1) are consistently accurate to ±0.01 foot; (2) do not affect the integrity and chemistry of groundwater samples; (3) do not affect the groundwater chemistry or well materials; and (4) can be thoroughly decontaminated between wells. The use of alternative measurement methods or devices must be approved by the Agency Hydrogeologist and documented in the field notes. Information regarding alternative measurement methods or devices will be included in groundwater data reports. When using alternative measurement devices, the device will be operated pursuant to the manufacturer's instructions for the instrument's use and its limitations noted in groundwater reports.

2.2 DECONTAMINATION OF WATER LEVEL MEASURING EQUIPMENT

To prevent potential cross contamination of wells, water level measuring equipment should be cleaned prior to use at each well. USGS California Water Science Center Staff recommends the use of a dilute (0.1 – 2%) Liquinox soap solution followed by a DI water rinse. Equipment should be disinfected with a dilute bleach solution, or with methanol or

ethanol, if biological contamination is suspect. Disinfection should be followed by a DI water rinse.

3.0 SAMPLING PROCEDURES FOR MONITORING WELLS

3.1 PRE-FIELD CHECKLISTS AND DOCUMENTATION

Pre-field Checklists (Included in Appendix A)
Prior to entering the field, MWA personnel will review the *Groundwater Sampling Equipment Checklist* included in Appendix A. The checklist may be modified to meet MWA project specific needs.

Documentation of the Sampling Event

1. The *Field Sampling Plan* documents the equipment and procedures used during a sampling event. Any deviations from the sampling plan must be approved by the Agency Hydrogeologist and clearly documented in the field notes.
2. Upon arrival at the well site, field personnel will inspect the wellhead and surface completion of the well. This process will be documented on a *Monitoring Well Surface Completion Inspection Form* (Appendix B).
3. Depth to water, well purging and sampling information, water quality parameter measurements, etc., will be recorded on a well specific *Groundwater Purging & Sampling Data Sheet*.
4. The possession of groundwater samples is documented by filling out a chain of custody (COC) form. The COC is used to document each time samples change possession. The COC also lists what types of analyses the sample will be tested for. A blank COC form and an example of a completed COC example are included in Appendix C.

~~*3.2 WELL GAUGING*~~

~~The depth to groundwater in each casing at the well will be measured and recorded prior to initiation of purging and sampling activities. Depths to groundwater will be measured in accordance with procedures described in Section 2.1.~~

~~*3.3 PURGING AND SAMPLING PROCEDURES*~~

~~The goal of purging a well prior to sampling is to remove stagnant water from the well and prevent stagnant water from entering samples, as they are collected. Stagnant water is not representative of formation groundwater. The goal of sampling is to collect unaltered samples that are representative of the physical and chemical composition of groundwater in the immediate vicinity of the well being sampled. The MWA considers an industry standard of three casing volumes of water purged from a well adequate to remove the majority of stagnant water in the well casing and filter material. Additional well volumes may be purged from a well prior to sampling if field readings indicate that purged water is not representative of groundwater.~~

~~Newly constructed wells will be sampled a minimum of one week following development to allow the majority of fine-grained material remaining suspended in the water column to settle. These "fines" may alter the physical and chemical properties of the groundwater sample and may not accurately reflect the quality of groundwater in the~~

Implementation of proper COC procedures during each sampling event will be documented by using a COC form. A blank COC form is included in Appendix C and an example of a completed COC form is provided as Appendix E.

All written entries (i.e., field logbook, COC records, *Groundwater Purging & Sampling Data Sheet*, etc.) will be legible and written in blue or black ink. Errors will be corrected by crossing a line through the error, entering the correct information, and initialed by the individual making the correction. Errors will not be obliterated or rendered unreadable.

3.7 SAMPLE HANDLING PROCEDURES

The following procedures should be used to minimize the potential of sample cross-contamination:

- During sampling activities, disposable Nitrile gloves will be worn and changed immediately when soiled in order to minimize the potential for sample cross-contamination. A new pair of gloves will be worn when collecting each sample.
- Laboratory provided sample containers will be ordered and used for each sampling event.
- Preservatives should be added at the laboratory prior to shipment of the sample containers to the Agency.
- Do not touch the interior of the sample container or container cap with gloves or sampling equipment.
- Sampling equipment will be new or decontaminated, in accordance with the procedures outlined in Section 3.0, prior to use at each sampling location.
- Sample containers will be placed in clear, leak resistant plastic bags and stored in a cooled ice chest immediately after collection. The tightness of container caps should be checked prior to placing the container into the plastic bag. Proper COC procedures will be maintained during each sampling event.
- If samples are not transported to the laboratory on the day of collection, they will be stored overnight in a secured location (e.g., MWA office) under proper COC procedures. Prior to overnight storage, the cooler(s) will be restocked with fresh ice.

3.8 SAMPLING EQUIPMENT DECONTAMINATION

All monitoring and sampling equipment will be new or decontaminated prior to use for sampling.

1. Monitoring equipment will be decontaminated prior to, and immediately following use, by applying a weak solution of non-phosphate detergent (e.g., Liquinox®) and potable water to the water level probe and any portion of the meter that is inserted through the water column of the well. Any portion of the meter where detergent had been applied will be subsequently rinsed twice with de-ionized water.
2. Sampling equipment (down-hole pump) will be disassembled and cleaned using a weak non-phosphate detergent and potable water solution. An inspection of the equipment will be performed to ensure no visible contamination is present. The sampling equipment will be reassembled and approximately 5 gallons of weak non-phosphate detergent solution will be pumped through the pump assembly, followed by approximately 5 gallons of deionized water.

APPENDIX A
FIELD CHECKLISTS

GROUNDWATER SAMPLING EQUIPMENT CHECKLIST

Paperwork
Well Construction Details
Bid Packet (including Technical Provisions and Specifications)
Field Sampling Plan
Phone Contact List
Copies of any required permits

Health and Safety
Health and Safety Plan
Drinking water/Gatorade
Steel-toed Boots
Hardhat
Sunscreen
Safety Vest
Safety Glasses
Hearing protection
Gloves (Nitrile, leather, etc.)
Fire Extinguisher
First Aid Kit
Paper Towels

Meters
Water Level Meter
Well Sounder for Total Depths
~~Water Quality Meter (Horiba U-10)~~
~~Horiba Flow Cell~~
~~La Motte Turbidity Meter~~
~~Calibration Solutions for WQ Meters~~

Documentation
Field Notebook
Digital Camera
Clipboard
Well Sampling/Development Forms
Pens: Ball Point, Markers, etc.
Calculator
Engineering Scale

~~*Purging Equipment*~~
~~Pump and Control Box~~
~~Generator~~
~~Disposable Tubing~~
~~Tubing Cutter~~
~~Graduated Beaker (for low-flow sampling)~~
~~Flow Cell~~

Decon Equipment
Buckets
Decon Brushes
DI Water
Spray Bottles
Alconox/Liquinox (SOAP)
Paper Towels

~~*Sampling*~~
~~Disposable Bailers~~
~~VOC sampling tips for bailers~~
~~Twine/String~~
~~Sample Labels~~
~~Chain of Custody Forms~~
~~Sample Containers (Bottles, Jars, etc.)~~
~~D.O. cup for Horiba~~
~~Zip-loc Bags~~
~~Ice Chest & Ice~~
~~Lab Blank Water~~
~~Sample Collection Chamber~~

Miscellaneous
Well Keys
Tape Measures
Marking paint
Duct Tape
Work table and chair (if no tailgate)
Tools
Trash bags
Stop Watch
Scissors

Any other equipment you can think of for each job!

APPENDIX B
FIELD LOGBOOK PROCEDURES

MWA WATER RESOURCES LOGBOOK FORMAT

A typical field logbook will include all activities conducted in the field each day. Since this can amount to a large volume of information, the following format should be used to organize and expedite review of the information. In addition, since multiple personnel may use the same logbook, the same format should be used by all.

Remember, a field logbook is admissible in a courtroom. Write information in a clear and concise format. Drawings of particular objects, areas, wells, maps, etc. should be used whenever possible.

Format Example:

Date: Project Name: Job #

Personnel on site: Current Weather:

TASK: List the day's task to be completed. If a continuous monitoring/maintenance project, just reference the page the task is on.

PROCEDURES: How are you going to complete the task? What equipment will you use? Are there any special requirements?

HEALTH AND SAFETY: Reference the Health and Safety Plan and any special requirements of the job. Describe if any site conditions have changed or changes in the level of safety needed to complete the tasks.

PARAMETERS: If sampling, list the type of sample containers used, what you're sampling for, any preservative, and the methods used to sample.

NOTES: Any notes associated with the job/task.

TIME: Write the time you started the task (in the text section).

TEXT: Any text related to the task as it happens. Don't be afraid to write **everything** that you observe. The more information the better, as long as it's organized.

TIME: Write the time you completed the job

CLOSING: Sign and date the last page **each day.**

Location HI-1 Oro Grande Date June 25th 2008

Project / Client Fish & Game Wells

Job 310 Data Collection HI-1c WQ Sampling

Project Name: Data Collection

Job # 310

Personnel on site: Ben Christenson

Current Weather: Clear, Light breezy Warm, Highs Near 100°f

Task: Purge each well casing and obtain a representative water Quality Sample. SWN 06N04W30K16

Procedures: Refer to MWA Standard Operating procedures for ground water Monitoring and Sampling.

Health & Safety: Refer to MWA H&S Plan. Additionally, use plenty of sunscreen and drink fluids frequently.

Parameters: Use ~~a~~ a two inch Grundfos pump to purge well & fill the sample containers, two 1 liter poly bottles and one 500ml poly bottle, using no preservatives. Items to be sampled for are on the Mobile Analysis list sent to lab w/ samples.

Location HI-1 oro Grande Date June 25th cont'd

Project / Client Fish & Game Wells

HI-1c Water Quality Sampling Scale

1030 Arrive on site, Begin decon of equipment & set up, & calibration.

NOTE: Late start time due to department Meeting.

NOTE: Buried truck in sand approaching well. Will have to work off tables.

1240 Equipment decon'd & set up, begin purging.

1345 Purging complete, parameters are stable, Collect sample

NOTE Seth of MWA on-site at 1310 to pick up sample.

1425 Sample truck unstuck, Seth off site with samples on ice to meet lab courier, I continue packing up & decon'ing equipment

1530 Equipment decon'd & packed up, well secured, depart for day.

Ben C. 6-25-08

APPENDIX C
FIELD FORMS

Mojave Water Agency	**MOJAVE WATER AGENCY** 22450 Headquarters Apple Valley, CA 92307	**Monitoring Well Surface Completion Inspection Form**

Well Identification Information

State Well Number-_____ Common Name- _____

Surface Inspection Checklist

- ☐ Crash Posts
- ☐ Name Plate
- ☐ Foundation
- ☐ Vegetation
- ☐ Debris
- ☐ Access
- ☐ Well ID Sticker
- ☐ Casing
- ☐ Lid
- ☐ Caps
- ☐ Lock
- ☐ Paint
- ☐ Other
- ☐ No Discrepancies Present

Brief Description/Notes- _____

Technician- _____ **Date-** _____

Technician(s) Intls._____/_____.

WATER-LEVEL DATA SHEET

ALTO SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks	Tape Used	Common Name
M	1	342726117082401	04N03W12A01	3115.77	Top of steel casing	2										Del Oro-a
M	1	342726117082402	04N03W12A02	3115.77	Top of steel casing	2										Del Oro-b
M	2	342938117111901	05N03W27E03	2952.58	Top of steel casing	2.33										A.V. Ranchos-a
M	2	342938117111902	05N03W27E04	2952.58	Top of steel casing	2.33										A.V. Ranchos-b
M	2	342938117111903	05N03W27E05	2952.58	Top of steel casing	2.33										A.V. Ranchos-c
M	2	342938117111904	05N03W27E06	2952.58	Top of steel casing	2.33										A.V. Ranchos-d
M	3	342929117133001	05N03W30A01	2959.78	Top of steel casing	1.65										Rincon Rd.-a
M	3	342959117133002	05N03W30A02	2959.78	Top of steel casing	1.65										Rincon Rd.-b
M	3	342959117133003	05N03W30A03	2959.78	Top of steel casing	1.65										Rincon Rd.-c
M	5	343145117163501	05N04W14D01	2739.49	Top of steel casing	1.83										Upper Narrows-a
M	5	343145117163502	05N04W14D02	2739.49	Top of steel casing	1.83										Upper Narrows-b
M	5	343145117163503	05N04W14D03	2739.49	Top of steel casing	1.83										Upper Narrows-c
M	5	343145117163504	05N04W14D04	2739.49	Top of steel casing	1.83										Upper Narrows-d
S	6.1	343239117172401	05N04W03P03	2708.18	Top of steel casing	1.49										Stoddard Wells Ag
S	6.1		05N04W03N01	2710.27	Top of PVC casing	1.03										Stoddard Wells 2 inch
S	7	343343117172601	06N04W34M08	2738.73	Access Plug top of casing	1.4										County Park well
S	8	343337117183101	06N04W33N01	2678.86	1/2" access hole	-5.1										H & H Well
S	6	343111117165801	05N04W15K01	2747.57	slot btwn plate & casing	1.6										Kemper Campbell
M	40	342805117164501	04N04W03A02	2986.95	Top of steel casing	1.2										SF-1-a
M	40	342805117164502	04N04W03A03	2986.95	Top of steel casing	1.2										SF-1-b
M	40	342805117164503	04N04W03A04	2986.95	Top of steel casing	1.2										SF-1-c
M	40	342805117164504	04N04W03A05	2986.95	Top of steel casing	1.2										SF-1-d
M	41	343004117153801	05N04W23R03	2771.88	Top of steel vault	0.00										F&G H1-2 Narrow park-a
M	41	343004117153802	05N04W23R04	2774.01	Top of steel vault	0.00										F&G H1-2 Narrow park-b
M	41	343004117153803	05N04W23R05	2774.01	Top of steel vault	0.00										F&G H1-2 Narrow park-c
M	41	3430041171538O5USGS	05N04W23R07	2773.99	Top of steel vault	0.00										F&G H1-2 Narrow park-d
M	41.1		05N04W14L01	2745.95	Top of steel vault	0.00										North Narrows Park-a
M	41.2		05N04W14L02	2745.95	Top of steel vault	0.00										North Narrows Park-b
S	42	342840117153301	05N04W35J02	2846.19	3" access tube (S. side)	1.6										Fish Hatchery

Meas.Method: A=airline B=analog C=calibrated airline E=estimated F=transducer G=press.gage H=calibrated press.gage L=geophysical log M=manometer N=non-rec.gage O=observed R=reported S=steel tape V=calibrated elec.tape Z=other

Site Status: A=atmos-press. B=tide stage D=dry E=recently flowing F=flowing G=nearby flowing H=nearby recently flowing I=injector site M=plugged N=meas-discontinued O=obstruction P=pumping R=recently pumped S=nearby pumping T=nearby recently pumping V=foreign substance W=well destroyed X=afffected by surface water Z=other

Run Frequency Color Cod

RED = MONTHLY

GREEN = SEMI-ANNUAL

Technician(s) Intls._____/_____.

WATER LEVEL DATA-SHEET

ALTO SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks	Tape Used	Common Name
M	44	342814117150501	04N04W01C02	2825.10	Top of steel casing	2.2										Jess Ranch-1-a
M	44	342814117150502	04N04W01C03	2825.10	Top of steel casing	2.2										Jess Ranch-1-b
M	44	342814117150503	04N04W01C04	2825.10	Top of steel casing	2.2										Jess Ranch-1-c
M	44	342814117150504	04N04W01C05	2825.10	Top of steel casing	2.2										Jess Ranch-1-d
S	4	342916117145501	05N04W25Q01	2794.24	Top of steel casing	1.4										Metal Shack well
S	45	342729117144501	04N04W01R01	2851.77	Slot in outer casing (S.E.)	1.3										Jess Ranch (shack well)
M	45.1	342514117134801	04N03W19G02	2886.26	Top of metal box	3.3										Rock Springs 1-a
M	45.1	342514117134802	04N03W19G03	2886.26	Top of metal box	3.3										Rock Springs 1-b
M	45.1	342514117134803	04N03W19G04	2886.26	Top of metal box	3.3										Rock Springs 1-c
M	45.1	342514117134804	04N03W19G05	2886.26	Top of metal box	3.3										Rock Springs 1-d
M	45.1	342514117134805	04N03W19G06	2886.26	Top of metal box	3.3										Rock Springs 1-e
M	46	342435117135702	04N03W30D05	2905.67	Top of PVC well	2.05										O&M Rock Springs Field Ofc.
M	47	342318117141101	04N03W31L06	2923.19	Top of steel casing	0.8										Deep Creek-1-a
M	47	342318117141102	04N03W31L07	2923.19	Top of steel casing	0.8										Deep Creek-1-b
M	47	342318117141103	04N03W31L08	2923.19	Top of steel casing	0.8										Deep Creek-1-c
M	47	342318117141104	04N03W31L09	2923.19	Top of steel casing	0.8										Deep Creek-1-d
S	48	342516117141801	04N03W19M01	2911.61	op of steel casing inside pyram	1										Green Pyramid well
S	48.1	342305117145201	04N04W36Q01	2921.80	Access tube TOC	1.22										Hesperia Lake
S	49	342124117144401	03N04W12Q02	3013.11	Elec. Cord inlet (N. side)	0.3										Lake Arrowhead Rd.
M	39	342519117240701	04N05W21H01	3535.74	Top of steel vault	0.00										MOGW
M	--	343030117300901	05N06W22E01	3269.57	Top of steel casing	1.4										Phelan-1-a
M	--	343030117300902	05N06W22E02	3269.57	Top of steel casing	1.4										Phelan-1-b
M	--	343030117300903	05N06W22E03	3269.57	Top of steel casing	1.4										Phelan-1-c
M		342923117370601	05N07W28L01	3504.02	Top of steel vault	0.00										MSCW
S		343712117361701	06N07W10P02	2865.26	rgest bolt on TOC is access pl	1.24								Need to sign in at gate.		El Mirage Airport

Meas.Method: A=airline B=analog C=calibrated airline E=estimated F=transducer G=press.gage H=calibrated press.gage L=geophysical log M=manometer N=non-rec.gage O=observed R=reported S=steel tape V=calibrated elec.tape Z=other

Site Status: A=atmos-press. B=tide stage D=dry E=recently flowing F=flowing G=nearby flowing H=nearby recently flowing I=injector site M=plugged N=meas-discontinued O=obstruction P=pumping R=recently pumped S=nearby pumping T=nearby recently pumping V=foreign substance W=well destroyed X=affected by surface water Z=other

Run Frequency Color Coc

RED = MONTHLY

GREEN = SEMI-ANNUAL

WATER-LEVEL DATA SHEET

Technician(s) Intls._____/_____.

TZ SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks	Tape Used	Common Name
M	1	343425117195601	06N04W30R01	2646.70	Top of steel vault	0.00										TZ-1-a
M	1	343425117195602	06N04W30R02	2646.70	Top of steel vault	0.00										TZ-1-b
M	1	343425117195603	06N04W30R03	2646.70	Top of steel vault	0.00										TZ-1-c
S	2	343430117202401	06N04W30P05	2661.49	Cap @ center of lid	0.85										Well#1 City of Adelanto
M	3	343710117211701	06N05W12K01	2594.27	Top of steel casing	2.24										NW-2 (VV-#7)
M	4	343732117211801	06N05W12G01	2597.14	Top of PVC well	1.35										OW-6 (VV-#6)
M	5	343631117211001	06N05W13G08	2571.69	Top of PVC well	2.1										OW-2 (VV-#9)
S	6	343433117194201	06N04W29M01	2655.01	Top of casing	0.7										Gary & Sue
M	7	343435117195501	06N04W30J05	2647.05	Top of steel casing	0.89										Riverside Cement
M	8	343444117200401	06N04W30K14	2639.16	Top of steel vault	0										H 1-1-a
M	8	343444117200402	06N04W30K15	2639.40	Top of steel vault	0										H 1-1-b
M	8	343443117200401	06N04W30K16	2639.15	Top of steel vault	0										H 1-1-c
M	8.1		06N04W19E06	2612.15	Top of steel vault	0										TZ-2-a
M	8.2		06N04W19E07	2612.15	Top of steel vault	0										TZ-2-b
M	8.3		06N04W19E08	2611.21	Top of steel vault	0										TZ-2-c
M	8.4		06N04W19E09	2611.21	Top of steel vault	0										TZ-2-d
M	9	343723117205501	06N05W12H01	2582.60	1" access pipe (E side)	0.6										Hamm AG
M	10	243730117210401	06N05W12G04	2574.62	Top of steel casing	1.25										EPA-III
S	11	343858117202801	07N04W31L02	2621.52	Top of access hole	1.4										Barbosa Rd.
M	12	343839117210601	06N05W01A06	2550.17	Top of steel vault	0.00										TZ-3-a
M	12	343839117210602	06N05W01A07	2550.17	Top of steel vault	0.00										TZ-3-b
M	12	343839117210603	06N05W01A08	2550.17	Top of steel vault	0.00										TZ-3-c
M	12.1		06N05W01A09	2543.32	Top of steel vault	0.00										TZ-3-d
M	12.2		06N05W01A10	2543.32	Top of steel vault	0.00										TZ-3-e
S	13	343945117205801	07N05W25R04	2520.79	Top of access pipe	1.04										Heifer Hotel
M	14	344030117201101	07N04W19Q05	2592.17	Top of steel casing	0.00										Daily-1-a
M	14	344030117201102	07N04W19Q06	2592.17	Top of steel casing	0.00										Daily-1-b
M	14	344030117201103	07N04W19Q07	2592.17	Top of steel casing	0.00										Daily-1-c
M	15	344030117205701	07N05W24R09	2501.86	Top of access hole	1.53										Bryman Rd. Metal Box

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Run Frequency Color Coc

RED = MONTHLY

GREEN = SEMI-ANNUAL

WATER-LEVEL DATA SHEET

Technician(s) Intls._____/_____.

TZ SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks	Tape Used	Common Name
M	16	344028117211901	07N05W24R11	2506.81	Top of steel vault	0.00										H 2-1 F&G Bryman rd-a
M	16	344028117211701	07N05W24R12	2506.65	Top of steel vault	0.00										H 2-1 F&G Bryman rd-b
M	16	344028117212201	07N05W24R13	2508.49	Top of steel vault	0.00										H 2-1 F&G Bryman rd-c
M	17	344028117210601	07N05W24R05	2511.62	Top of steel casing	0.3										Older-1-a
M	17	344028117210602	07N05W24R06	2511.62	Top of steel casing	0.3	OBSTRUCTION @ ~30' (NOT MEASURED FOR WATER LEVEL)									Older-1-b
M	17	344028117210603	07N05W24R07	2511.62	Top of steel casing	0.3										Older-1-c
M	17	344028117210604	07N05W24R08	2511.62	Top of steel casing	0.3										Older-1-d
M	18	344159117205701	07N05W13H01	2475.80	Top of steel casing	2.16										EPA-5A-1
M	18	344159117205702	07N05W13H02	2480.27	Top of steel casing	2.75										EPA-5A-2
M	19	344200117205001	07N05W13H03	2475.82	Top of steel casing	3.24										EPA-5B
M	19.1		07N04W06F07	2448.188	Top of steel casing	0										Bunnel Peacock Farm
M	20	344524117193401	08N04W29E03	2398.23	Top of steel casing	2.3										Helendale-3-a
M	21	344524117193402	08N04W29E04	2398.23	Top of steel casing	2.3										Helendale-3-b
M	21	344524117193403	08N04W29E05	2398.23	Top of steel casing	2.3										Helendale-3-c
M	21	344524117193404	08N04W29E06	2398.23	Top of steel casing	2.3										Helendale-3-d
M	23	344609117182901	08N04W21M01	2380.27	Top of steel casing	2.03										BBB-1-a
M	23	344609117182902	08N04W21M02	2380.27	Top of steel casing	2.03										BBB-1-b
M	23	344609117182903	08N04W21M03	2380.27	Top of steel casing	2.03										BBB-1-c
M	23	344609117182904	08N04W21M04	2380.27	Top of steel casing	2.03										BBB-1-d
M	24	344611117200801	08N04W19G01	2453.33	Top of steel casing	2.03										Helendale-4-a
M	24	344611117200802	08N04W19G02	2453.06	Top of steel casing	2.3										Helendale-4-b
M	24	344611117200803	08N04W19G03	2453.06	Top of steel casing	2.3										Helendale-4-c
M	24	344611117200804	08N04W19G04	2453.06	Top of steel casing	2.3										Helendale-4-d
M	25	344333117225901	07N05W02B01	2512.06	Top of steel vault	0.00										TZ-4-a
M	25	344333117225902	07N05W02B02	2512.06	Top of steel vault	0.00										TZ-4-b
M	25	344333117225903	07N05W02B03	2512.06	Top of steel vault	0.00										TZ-4-c
S	26	344318117204701	07N04W06N01	2465.57	Slot (N.W. Side) of casing	1.9										Palisades River Well
M	27	344036117215201	07N05W23R01	2723.48	Top of steel casing	2.3										Older-2-a
M	27	344036117215202	07N05W23R02	2723.48	Top of steel casing	2.3										Older-2-b
M	27	344036117215203	07N05W23R03	2723.48	Top of steel casing	2.3										Older-2-c
M	28	343840117212701	06N05W01C01	2539.50	Top of steel casing	0.82										West Bank-a
M	29	343840117212702	06N05W01C02	2536.34	Top of steel casing	0.63										West Bank-b

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Run Frequency Color Co

RED = MONTHLY

GREEN = SEMI-ANNUAL

Technician(s) Intls._____/_____.

WATER-LEVEL DATA SHEET
ALTO / TZ SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks	Common Name
Q			04N05W11E01	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			04N05W11E02	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			04N05W11E03	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			04N05W11E04	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			04N05W11E05	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			04N05W11E06	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			04N05W11E07	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			04N05W11E08	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			04N05W11E09	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			04N05W11E10	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			04N05W11E11	3377.64	Top of Westbay Vault	0.00								WestBay	ALTO DEEP WELL
Q			03N04W04F01	3239	Top of Westbay Vault	0.00								WestBay	AWMW-1
Q			03N04W04F03	3239	Top of Westbay Vault	0.00								WestBay	AWMW-1
Q			03N04W04F04	3239	Top of Westbay Vault	0.00								WestBay	AWMW-1
Q			03N04W04F05	3239	Top of Westbay Vault	0.00								WestBay	AWMW-1
Q			03N04W04F06	3239	Top of Westbay Vault	0.00								WestBay	AWMW-1
Q			04N05W15G01		Top of Westbay Vault	0.00								WestBay	ALTO-2
Q			04N05W15G02		Top of Westbay Vault	0.00								WestBay	ALTO-2
Q			04N05W15G03		Top of Westbay Vault	0.00								WestBay	ALTO-2
Q			04N05W15G04		Top of Westbay Vault	0.00								WestBay	ALTO-2
Q			04N05W15G05		Top of Westbay Vault	0.00								WestBay	ALTO-2
Q			04N05W15G06		Top of Westbay Vault	0.00								WestBay	ALTO-2
Q			04N05W15G07		Top of Westbay Vault	0.00								WestBay	ALTO-2
Q			04N05W15P01		Top of Westbay Vault	0.00								WestBay	ALTO-3
Q			04N05W15P02		Top of Westbay Vault	0.00								WestBay	ALTO-3
Q			04N05W15P03		Top of Westbay Vault	0.00								WestBay	ALTO-3
Q			04N05W15P04		Top of Westbay Vault	0.00								WestBay	ALTO-3
Q			04N05W15P05		Top of Westbay Vault	0.00								WestBay	ALTO-3
Q			04N05W15P06		Top of Westbay Vault	0.00								WestBay	ALTO-3
Q			04N05W15P07		Top of Westbay Vault	0.00								WestBay	ALTO-3

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Run Frequency Color Code
BLUE = QUARTERLY

Technician(s) Intls._____/_____.

WATER LEVEL DATA SHEET

BAJA SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks	Tape Used	Common Name
M	1	345631116541401	10N01E20M01	2,093.84	Top of steel casing	1.85										YF-1-a
M	1	345631116541402	10N01E20M02	2,093.84	Top of steel casing	1.85										YF-1-b
S	2	350230116264001	11N05E16J01	1,651.12	Access through elbow	1.00										Afton
S	3	34581311636001	10N04E07Q01	1,766.14	Access plug at top of casing	0.00										Alvord Mtn. Rd.
M	5	345632116362701	10N04E19M02	1,710.28	Top of steel casing	4.1										F&G Old Mass well
M	6	345629116362901	10N04E19N02	1,703.90	Top of steel casing	2.56										F&G H3-2 Cady-a
M	6	345629116362902	10N04E19N03	1,701.28	Top of steel casing	2.51										F&G H3-2 Cady-b
M	6	345629116362903	10N04E19N04	1,700.96	Top of steel casing	2.35										F&G H3-2 Cady-c
M	7	345630116362201	10N04E19M06	1,704.14	Top of PVC casing	3.62										4" Well
S	8	345710116385601	10N03E15Q02	1,804.19	Access hole in casing cap	0.8										Cherokee Orchard well
S	9	345534116404801	10N03E28N04	1,818.33	Top of casing through access hole	1.1										Airplane Well
M	10	345542116383901	10N03E27J01	1,750.30	Top of steel casing	1.65										H3-1 (NS-1)-a
M	10	345542116383902	10N03E27J02	1,750.30	Top of steel casing	1.65										H3-1 (NS-1)-b
M	10	345542116383903	10N03E27J03	1,750.30	Top of steel casing	1.65										H3-1 (NS-1)-c
M	10	345542116383904	10N03E27J04	1,750.30	Top of steel casing	1.65										H3-1 (NS-1)-d
M	10	345542116383905	10N03E27J05	1,749.78	Top of steel casing	1.48										H3-1 (NS-1)-e
M	11	345549116373701	10N03E26H01	1,732.16	Top of steel casing	0.95										Camp Cady #1
S	12.1	345719116382101	10N03E35E03	1,807.49	Access plug at top of casing	1.24										Palma Vista East
S	13	345457116391901	10N03E34L02	1,795.43	Access hole in casing cap	1.7										Palma Vista Windmill
M	14	345104116384011	09N03E22R04	1,828.35	Top of steel casing	1.8										NS-2-a
M	14	345104116384022	09N03E22R05	1,828.35	Top of steel casing	1.8										NS-2-b
M	14	345104116384003	09N03E22R06	1,828.35	Top of steel casing	1.8										NS-2-c
M	14	345104116384004	09N03E22R07	1,828.35	Top of steel casing	1.8										NS-2-d
M	15	345043116393601	09N03E27E01	1,838.84	Top of 2" plug on top of casing	0.85										Newberry Springs Recharge Well
S	16	345409116404901	09N03E05H01	1,838.27	Top of 3/4" nipple in cap	1										Twin Lake Rd.
S	17	345330116425501	09N02E12A04	1,845.12	Top of steel casing	0.6										Ret. Marine Well
M	18	345416116451601	09N02E03G06	1,844.15	Top of steel casing	1.8										Calico East-a
M	18	345416116451602	09N02E03G07	1,844.15	Top of steel casing	1.8										Calico East-b
M	18	345416116451603	09N02E03G08	1,844.15	Top of steel casing	1.8										Calico East-c
M	18	345416116451604	09N02E03G09	1,844.15	Top of steel casing	1.8										Calico East-d

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Technician(s) Intls._____/_____.

WATER LEVEL DATA SHEET

BAJA SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks	Tape Used	Common Name
M	19	345404116451801	09N02E03K05	1851.273	Top of steel casing	1.8										Cailco West (Mitchell Ranch)-a
M	19	345404116451802	09N02E03K06	1851.273	Top of steel casing	1.8										Calico West (Mitchell Ranch)-b
M	19	345404116451803	09N02E03K07	1851.273	Top of steel casing	1.8										Calico West (Mitchell Ranch)-c
M	19	345404116451804	09N02E03K08	1851.273	Top of steel casing	1.8										Calico West (Mitchell Ranch)-d
M	19	345404116451805	09N02E03K09	1851.273	Top of steel casing	1.8										Calico West (Mitchell Ranch)-e
S	20	345516116440601	10N02E35A01	1872.116	1/4" access plug top of casing	0.82										Music Man Well
S	21	345446116485101	10N02E31L03	1834.58	Access plug at top of casing	0.73										Sycamore Mass Well
M	22	345259116514201	09N01E10Q02	1951.541	Top of steel casing	2.05										Site-E-a
M	22	345259116514202	09N01E10Q03	1951.541	Top of steel casing	2.05										Site-E-b
M	22	345259116514203	09N01E10Q04	1951.541	Top of steel casing	2.05										Site-E-c
M	23	345356116523001	09N01E04K01	1962.985	Top of steel casing	1.85										Site-B-a
M	23	345356116523002	09N01E04K02	1962.985	Top of steel casing	1.85										Site-B-b
M	23	345356116523003	09N01E04K03	1962.985	Top of steel casing	1.85										Site-B-c
M	24	345224116525701	09N01E16F01	1959.356	Top of steel casing	1.82										Site-F-a
M	24	345224116525702	09N01E16F02	1959.356	Top of steel casing	1.82										Site-F-b
M	24	345224116525703	09N01E16F03	1959.356	Top of steel casing	1.82										Site-F-c
M	24	345224116525704	09N01E16F04	1959.356	Top of steel casing	1.82										Site-F-d
S	25	345127116502701	09N01E23J01	1973.046	Top of steel casing	1.00										Santa Fe St.
S	26	345230116542101	09N01E15H01	1939.771	Top of steel casing	0.60										AG Field N. of Power Plant
S	27	345151116515201	09N01E22B06	1970.974	Top of casing (remove wooden cover)	0.70										Hi-Voltage Ranch
M	28	345204116543401	09N01E18R02	1982.042	Top of steel casing	1.98										MW-3 (DAGGETT RECHARGE)
M	29	345251116560601	09N01W12L02	2007.657	Top of steel casing	1.6										MC-2 (Sand-Trap)-a
~~M~~	~~29~~	~~345251116560602~~	~~09N01W12L03~~	~~2007.657~~	~~Top of steel casing~~	~~1.6~~										~~MC-2 (Sand-Trap)-b~~
M	29	345251116560603	09N01W12L04	2007.657	Top of steel casing	1.6										MC-2 (Sand-Trap)-c
M	29	345251116560604	09N01W12L05	2007.657	Top of steel casing	1.6										MC-2 (Sand-Trap)-d
M	30	345242116562101	09N01W12N04	2013.163	Top of steel casing	1.3										MC-3-a
M	30	345242116562102	09N01W12N05	2013.163	Top of steel casing	1.3										MC-3-b
M	30	345242116562103	09N01W12N06	2013.163	Top of steel casing	1.3										MC-3-c
M	30	345242116562104	09N01W12N07	2013.163	Top of steel casing	1.3										MC-3-d

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Run Frequency Color Cod

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Technician(s) Intls._____/_____.

WATER LEVEL DATA SHEET

CENTRO SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks	Tape Used	Common Name
M	1	342254116570401	09N01W11K12	2027	Top of steel casing	1.6										MC-4-a
M	1	342254116570402	09N01W11K13	2027	Top of steel casing	1.6										MC-4-b
M	1	342254116570403	09N01W11K14	2027	Top of steel casing	1.6										MC-4-c
M	1	342254116570404	09N01W11K15	2027	Top of steel casing	1.6										MC-4-d
M	2	345251116574201	09N01W10J12	2042	Top of steel casing	1.4										MC-1-a
M	2	345251116574202	09N01W10J13	2042	Top of steel casing	1.4										MC-1-b
M	2	345251116574203	09N01W10J14	2042	Top of steel casing	1.4										MC-1-c
M	2	345251116574204	09N01W10J15	2042	Top of steel casing	1.4										MC-1-d
M	3	345339116584501	09N01W04R02	2063	Top of steel casing	1.95										Barstow-2-a
M	3	345339116584502	09N01W04R03	2063	Top of steel casing	1.95										Barstow-2-b
M	3	345339116584503	09N01W04R04	2063	Top of steel casing	1.95										Barstow-2-c
M	4	345351116593302	09N01W04M05	2072	Top of steel casing	1.6										Barstow-1-a
M	4	345351116593303	09N01W04M06	2072	Top of steel casing	1.6										Barstow-1-b
M	4	345351116593304	09N01W04M07	2072	Top of steel casing	1.6										Barstow-1-c
S	5	345443116591701	10N01W33L03	2093	Access plug at top of casing	1.2										36426 Soapmine Rd.
S	6	345448117003301	10N01W32F12	2089	Access plug at top of casing	0.9										Leona Rd. AG.
M	7	345328116594301	09N01W09D05	2093	Top of steel casing	1.97										Barstow-3-a
M	7	345328116594302	09N01W09D06	2093	Top of steel casing	1.97										Barstow-3-b
M	7	345328116594303	09N01W09D07	2093	Top of steel casing	1.97										Barstow-3-c
M	7	345328116594304	09N01W09D08	2093	Top of steel casing	1.97										Barstow-3-d
S	8	345427117000701	10N01W32Q04	2080	Access plug at top of casing	1.3										Y2K-Junk Yard
S	9	345416117014601	09N02W01A02	2112	Top of steel casing	0										Pierce Ave
S	10	345421117031101	09N02W02B05	2132	Electrical access hole	1.3										Ramirez Ranch
M	11	345421117035301	09N02W03A01	2142	Top of steel casing	1.83										F-1-a
M	11	345421117035302	09N02W03A02	2142	Top of steel casing	1.83										F-1-b
M	12	345407117034701	09N02W02E01	2142	Top of PVC casing	1.86										F-2

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Run Frequency Color Co

RED = MONTHLY

GREEN = SEMI-ANNUAL

Technician(s) Intls._____/_____.

WATER LEVEL DATA SHEET

CENTRO SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks	Tape Used	Common Name
M	13	345406117044001	09N02W03E01	2151	Top of steel casing	1.92										F-3 Dairy-a
M	13	345406117044002	09N02W03E02	2151	Top of steel casing	1.92										F-3 Dairy-b
M	13	345406117044003	09N02W03E03	2151	Top of steel casing	1.92										F-3 Dairy-c
M	14	345341117082101	09N03W01R05	2198	Top of steel casing	1.8										Vernola-a
M	14	345341117082102	09N03W01R06	2198	Top of steel casing	1.8										Vernola-b
M	14	345341117082103	09N03W01R07	2198	Top of steel casing	1.8										Vernola-c
M	15	345448117075101	09N02W06M07	2192	Top of steel casing	1.9										Lenwood-2
M	16	345345117074901	09N02W06P02	2191	Top of steel casing	1.4										Lenwood-4
M	17	345350117074001	09N02W06L11	2191	Top of steel casing	2.3										Lenwood-1-a
M	17	345350117074002	09N02W06L12	2190	Top of steel casing	2.3										Lenwood-1-b
M	17	345350117074003	09N02W06L13	2190	Top of steel casing	2.3										Lenwood-1-c
M	17	345350117074004	09N02W06L14	2190	Top of steel casing	2.3										Lenwood-1-d
M	18	345347117074101	09N02W06P01	2191	Top of steel casing	1.8										Lenwood-3
M	19	345402117070401	09N02W06H06	2184	Top of steel pipe inside casing	1.3										Lenwood-5
S	20	345344117065901	09N02W05N08	2187	Top of steel casing	0.8										Lenwood Rd.
M	21	345126117091101	09N03W23H01	2239	Top of steel casing	1.95										Hodge 3
M	21	345123117094301	09N03W23L01	2230	Top of steel casing	3.2										Hodge-4
M	22	345124117094301	09N03W23F01	2230	Top of steel casing	2.6										Hodge-1-a
M	22	345124117094302	09N03W23F02	2230	Top of steel casing	2.6										Hodge-1-b
M	22	345124117094303	09N03W23F03	2230	Top of steel casing	2.6										Hodge-1-c
M	22	345124117094304	09N03W23F04	2230	Top of steel casing	2.6										Hodge-1-d
M	23	345146117094301	09N03W23C01	2226	Top of steel casing	1.95										Hodge-2
S	24	345112117101901	09N03W22J04	2239	Top of casing	0.44										AG Field well
M	25	345136117101201	09N03W23D02	2224	Top of steel casing	0.9										Hodge Outlet FCF
S	26	345234117101701	09N03W15A01	2222	Top of casing, access hole	1.1										Choi Orchard
M	27	345157117101201	09N03W14N01	2227	Top of steel casing	0.9										Mountain View Rd.
M	27.1		09N03W22M01	2239.299	Top of steel casing	2.25										Hinkley BLM-a
M	27.2		09N03W22M02	2239.299	Top of steel casing	2.25										Hinkley BLM-b
S	28	344859117113001	08N03W04A07	2279	Vertical slot at top of casing	1.2										Wind Well off Rte. 66
S	29	344818117151501	08N04W12C01	2351	Top of casing, access hole	1.1										Venus's well

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Run Frequency Color Co

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WATER LEVEL DATA SHEET

ESTE SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Este Key Well #	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks	Tape Used	Common Name
s	1	342728117053001	04N02W04Q01	Este41	3082.39	Top of steel casing	1.40										Del Oro 16"
M	2	342544117011501	04N01W18Q01	Este23	3007.44	Top of steel casing	1.00										Foothill Rd.
M	3	342715117015901	04N01W07D02	Este18	2949.04	Access hole in casing cap	1.50										Airport #1
M	4	342639117005501	04N01W07R01	Este33	2941.918	Top of 2" plug on top of casing	0.43										Rabbit Dry Lake
M	5	342643116592901	04N01W09P06	Este19	2972.95	Top of steel casing	2.10										Gas Station Monitoring Well
M	6	342639116580001	04N01W10R01	Este20	2945.849	Top of 2" plug on top of casing	0.33										Kendell Rd.
M	7	342848117002001	05N01W32K07	Este12	2942.553	Access plug in casing cap	0.65										Cove
s	8	342916117012601	05N01W31C01	Este42	3060.975	Access plug in casing cap	0.46										Cove West
M	9	342943116555201	05N01W29H01	Este07	2917.247	Top of 2" plug on top of casing	0.65										Harder
M	10	342943116555201	05N01W25G01	Este09	2849.445	Opening S.side of casing	2.35										McDowell Rd.
M	11	343155116543401	05N01E08N03	Este05a	2875.20	Top of steel casing	2.01										Northside-a
M	11	343155166543402	05N01E08N04	Este05b	2875.20	Top of steel casing	2.01								USGS Transducer (MEASURE FOR W.L.)		Northside-b
M	12	343417116574501	06N01W27R01	Este03	3036.771	Top of 2" plug on top of casing	2.09										247 Tank
s	13	343500116581401	06N01W27B01	Este44	3039.375	Top of steel casing	0.7										Algoman Fenced well
s	14	34382116595901	06N01W05J01	Este43	3225.37	Access plug in casing cap	0.35										Dog Well
M	14	342850116562301	05N01W36F01	Este10a	2850.673	Top of steel casing	1.85										Rancho Lucerne Channel-a
M	14	342850116562302	05N01W36F02	Este10b	2850.673	Top of steel casing	1.85										Rancho Lucerne Channel-b
M	14	342850116562303	05N01W36F03	Este10c	2850.673	Top of steel casing	1.85										Rancho Lucerne Channel-c
M	14	342850116562304	05N01W36F04	Este10d	2850.673	Top of steel casing	1.85										Rancho Lucerne Channel-d
M	15	342850116562305	05N01W36F05	Este10e	2850.673	Top of steel casing	1.85										Rancho Lucerne Channel-e
M	16	342826116554101	05N01W36R03	Este13	2859.019	Top of 2" plug on top of casing	0.63										Rancho Lucerne AG
M	17	342738116553901	04N01W01R04	Este31a	2873.52	Top of steel casing	2.40										Rancho Lucerne B (R.L.-B)-a
M	17	342738116553902	04N01W01R05	Este31b	2873.52	Top of steel casing	2.40										Rancho Lucerne B (R.L.-B)-b
M	17	342738116553903	04N01W01R06	Este31c	2873.52	Top of steel casing	2.40					Obstructed					Rancho Lucerne B (R.L.-B)-c
M	17	342738116553904	04N01W01R07	Este31d	2873.52	Top of steel casing	2.40										Rancho Lucerne B (R.L.-B)-d
M	18	342738116553905	04N01W01R08	Este15a	2874.70	Top of steel casing	3.50										Rancho Lucerne A (R.L.-A)-a
M	18	342738116553906	04N01W01R09	Este15b	2874.70	Top of steel casing	3.50										Rancho Lucerne A (R.L.-A)-b

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WATER LEVEL DATA SHEET

ESTE SUB-BASIN

Run freq	RTE #	USGS Site I.D.	SWN	Este Key Well #	Altitude of LSD	M.P. Access	MP-feet	Last meas. W.L. TOC	Last meas. DATE	Site Stat.	Current Meas. W.L. TOC	Current Meas. DATE	Meas. Meth.	Site Stat.	Remarks		Tape Used	Common Name
M	19		05N01E24D05	Este06	3016.29	plug at top of steel casing	0.77											Boy's Home
M	20	342518116505401	04N01E23K01	Este26a	3122.52	Top of steel casing	1.75											LUV-1-a
M	20	342518116505402	04N01E23K02	Este26b	3122.52	Top of steel casing	1.75											LUV-1-b
M	21		04N01E16N02	Este35	3040.45	Top of 2" plug on top of casing	0.8											Russell-East
M	22		04N01E16N01	Este39	3038.86	Top of 2" plug on top of casing	0.11											Russell-West
M	23	342544116555001	04N01W13R01	Este25a	3086.25	Top of steel casing	2.80											Pipeline-a
M	23	342544116555002	04N01W13R02	Este25b	3086.25	Top of steel casing	2.80											Pipeline-b
M	23	342544116555003	04N01W13R03	Este25c	3086.25	Top of steel casing	2.80											Pipeline-c
s	23.1		04N01W15K04		3007.03	Top of plug on top of casing	0.80											Copple Well
S	24	342625116571301	04N01W14C02		2945.33	Access hole in casing cap	0.73											Lucerne Valley Mortuary
S	25	340804116205901	01N06E34D03		3031.42	Top of Vault	0.00											Joshua Tree (Cemetery)-a
S	25	340804116205902	01N06E34D04		3031.42	Top of Vault	0.00											Joshua Tree (Cemetery)-b
S	25	340804116205903	01N06E34D05		3031.42	Top of Vault	0.00											Joshua Tree (Cemetery)-c

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MWA Transducer Procedures

(**DRAFT** – February 2012)

Transducer A to Z

Intro

Basic concepts and tools used

1. Overall concept: A transducer allows agency to record water levels by measuring the pressure of the water above it and converting it into a level. This allows measurements to be taken without the labor of manually recording a level. Recording interval is variable.
2. Solinst: The name of the company who made the transducers and software that are described in this paper.
3. What a transducer is: A pressure measurer/recorder.
4. Pressure in feet of head (or water): Most people think of pressure as a PSI, The Solinst software converts all recorded pressures into feet of head. Even the recorded barometric pressure is in feet of head.
5. Barometric and water pressure: A transducer measures a total pressure. This pressure is that of the water column above it plus the atmospheric pressure. The atmospheric pressure changes so it must be recorded and subtracted from the recorded transducer pressure in order to get the actual water level.
6. Baro and level loggers: Due to barometric pressure changes all level loggers (transducers that read water levels) must be associated with a baro logger (transducer that measures barometric pressure of atmosphere). They must have identical recording intervals and all level loggers must be within a 15 mile range of the baro logger. I refer to this baro logger, and all level loggers associated with it as a transducer run; they all are tied together should be downloaded around the same time.
7. Level Loader: is a hand held device primarily used to collect transducer data in field without a laptop.

Installing a Solinst level logger

These are all the steps to install a well with a level logger. The idea is to hang a level logger on a cable under the water in a well. Then an offset is programmed. Finding the offset is complicated but it is just the total distance from the measuring point of the well to the level logger. The offset is then programmed into the level logger and that number is automatically subtracted from the level It records, producing a level from the measuring point, rather than the level of water over level logger.

1. Research.

a. Determine lowest possible water level and fluctuation variation from history of recorded water levels. This will determine where to hang the level logger and what type of level logger to use. Most new Gold level loggers are designed to handle 65 feet of water. Wells with fluctuations near 65 feet will require a logger with greater range.

b. Determine well altitude. This is very important to know when programming a transducer. Inaccuracy in altitude will lead to inaccurate readings.

c. Determine hanging method. Most wells are PVC and holes could easily be drilled to loop cable and hang transducer. There are occasions when an all steel well will be chosen and some welding may be necessary to safely hang transducer.

2. Tools and supplies needed.

Level logger, Baro logger, Stainless Steel cable, Ferrules', Cable cutter, Crimper, Measuring tapes (hand held and 200'), Water level meter (ET-2), Cordless drill, 1/8" drill bit, WR laptop, Power inverter, USB cradle optical reader, Log book, Calculator.

3. Drop Procedure.

a. Connect level logger to steel cable on reel. Crimp a loop through level logger cap and attach using ferrules.

b. Lower cable to desired length. After you have determined the approximate desired transducer depth through research, lower stainless steel cable attached to water level tape down well. Lower to desired depth and mark where you will cut cable. Pull cable and water level tape. After you pull cable out of well you can cut cable at mark.

This initial level accuracy is only approximate. Being within a few feet of desired depth should be fine if you did good research.

c. Connect cable to well cap by drilling two 1/8" holes in cap and looping with ferrules.

d. Program baro logger. Set baro logger to log every 5 seconds. Be sure to program altitude. Start logging.

e. Program level logger. Include altitude, Location=SWN , and Project ID=common name. Set level logger to log every 5 seconds, start logging.

f. Drop level logger into well leave set at regular logging position for 1-2 minutes.

g. Note time, pull up level logger.

h. Get water level using calibrated electric tape.

4. Determine Offset.

a. Download baro logger data, note baro level at time level logger was in logging position. Stop baro logger from logging.

b. Download level logger data, determine level from readings while level logger was in logging position (note: at this point logger level = depth under water + barometric level).

c. Offset = logger level + water level – barometric level

4. Final program.

a. Stop level logger from logging.

b. Program offset, as a **negative** number.

c. Set program to log at intervals and start time equal to that of local baro logger.

d. Drop level logger, in the future any download will yield level as uncompensated (water level + Barometric pressure) depth to water below measuring point as a negative number.

5. Note Taking

Be sure to have the following information in the logbook

a. Transducer serial # and SWN
b. Offset value and numbers used to determine value.
c. Altitude programmed.
d. Logging interval and start time.
e. Make all necessary changes to Transducer master list.

Uploading from level logger to level loader

The following procedures involve the use of the Level Loader Gold to gather the transducer data in the field.

1. Take water and record a field water level measurement of well you are downloading from. Record water level in logbook along with SWN, transducer serial # and programmed offset.
2. The level logger data can be loaded directly to a laptop or PC by use of a USB optical cradle or by the level loader. The level loader is much simpler and will be described here.
3. Turn level loader on, and scroll to "Connect to Logger."
4. Attach level loader to level logger or data cable connected to level logger using correct cable extension and activate level loader. The level loader will then display logger info. At this time you will be able to download the data by selecting the download data option. The process is the same for baro loggers and level loggers. Always download data from the baro logger at the end of your run after all associated level loggers have been done.
5. When the data is done loading, the logger will revert to its main menu. Make sure you keep an eye on the logger for any error codes.

In the event of an error try disconnecting the level loader from the data cable or logger. Check for and displace any debris you find in or around the sensors. Reattach and repeat procedure.

Uploading from level loader to PC

Pulling the data out of the level loader and loading it onto the pc seems simple, but this is the part of the operation in which you can start to find errors.

1. Take water and record a field water level measurement of well you are downloading from. Record water level in logbook along with SWN, transducer serial # and programmed offset.
2. Before you begin make sure that your PC is equipped with the latest version of Solinst level logger software. These downloads are available online at Solinst.com.
3. Begin by opening level logger program (at the time this document was written 3.2.1 was latest version).
4. Now attach the level loader to your PC via the USB port.
5. On the main menu of the level loader there is "Data to PC" option. Select this option and the logger should display the number of files ready for transfer. Now the loader is ready to upload.
6. On your level logger software you will need to set your com port to equal the USB port. This number can vary from computer to computer so some trial and error may be required.
7. Once you have the Com port selected select the level loader tab. Select "download," then "all". You will receive an error if you are on the incorrect com port or if the level loader is not set to "Data to PC."

8. You will now be asked to select a destination folder in which to save your files. The default folder is labeled data and is in the level logger program folder on your c:\. I recommended that a new folder is made at a destination germane to transducer data on the network. The files will be saved as .lev files, files only functional in the level logger software.
9. I recommended that all of the files be erased on the level loader. This function is actionable by simply clicking the "erase" option under the level loader tab. Erasing the data will save you a lot of trouble and confusion in your next download. Make sure all the .lev files are saved in the folder you decided on before erasing the files on the level loader.
10. At this point you can shut down and disconnect level loader.

Data compensation

The real water levels come to light in this section. This allows quality assurance to be conducted and useful data to be generated.

There are different ways to compensate the data. The way laid out in this document works the best for me, but feel free to explore software to find out other techniques.

1. In the level logger software close all of the downloaded files from the level loader except for the barometric file you have downloaded (if you have closed the software just open the baro file from where you saved it and continue).
2. Select the barometric compensation button in the "logger info" tab. You will then be asked to indicate type of file you have open. Select barometric.
3. You will then be asked to select the submerged level logger file to be compensated. Go to where you saved the .lev files on the network and select the first file you wish to compensate.
4. After you select the file you will be able to do up to 4 types of data correction. Just check the barometric compensation button, ignore the rest and click next. Compensation only takes a moment and you are asked for the location of where you would like to save the compensated file. The file is still a .lev file with "compensated" thrown in the filename. Save the file.

Note: if you get an error "-520 time date stamps must overlap" when compensating, your baro file does not match the logger file. Either the logger is not set to take records at the same time and frequency as the baro logger or there are more records on the level logger then on the baro logger. Even if you get this error you will get compensated data for all the times that the level logger and baro do overlap, but there may be data gaps.

5. At this point the levels in the .lev files should be accurate water level measurements. You can look at the graph generated and do a quick QAQC check by comparing the last reading with the water level measurement taken at time of download.

6. Repeat process for each level logger file until they are all compensated and saved.

Exporting data.

It is time to pull our data from the Solinst level logger software to a more usable format.

1. To complete the export you can either open all of the compensated files to be exported at the same time or open and close them as you go. I prefer to open all of the files in the Solinst software and close the files after I export them.
2. In the "file" tab you select export, then select data. You will notice an option to export the graph, but this graph cannot be changed in type, scale, or design; which is why graph generation will be handled in Excel later.
3. The level logger software will then ask you for a destination folder and to name the file. A new folder on the network would work nicely. I like to name the file by its common name, SWN has also been used.
4. The file is then exported and saved as a .csv file. Close the file and proceed to the next file.

Once you have exported the files you will be done with Solinst level logger software!

Processing the data and quality assurance

Now that you have the data in a PC software friendly format you can use Excel to setup data. You will also do a final QAQC check.

I will not go into detail on the step by step of the Excel processing but you should have a few things.

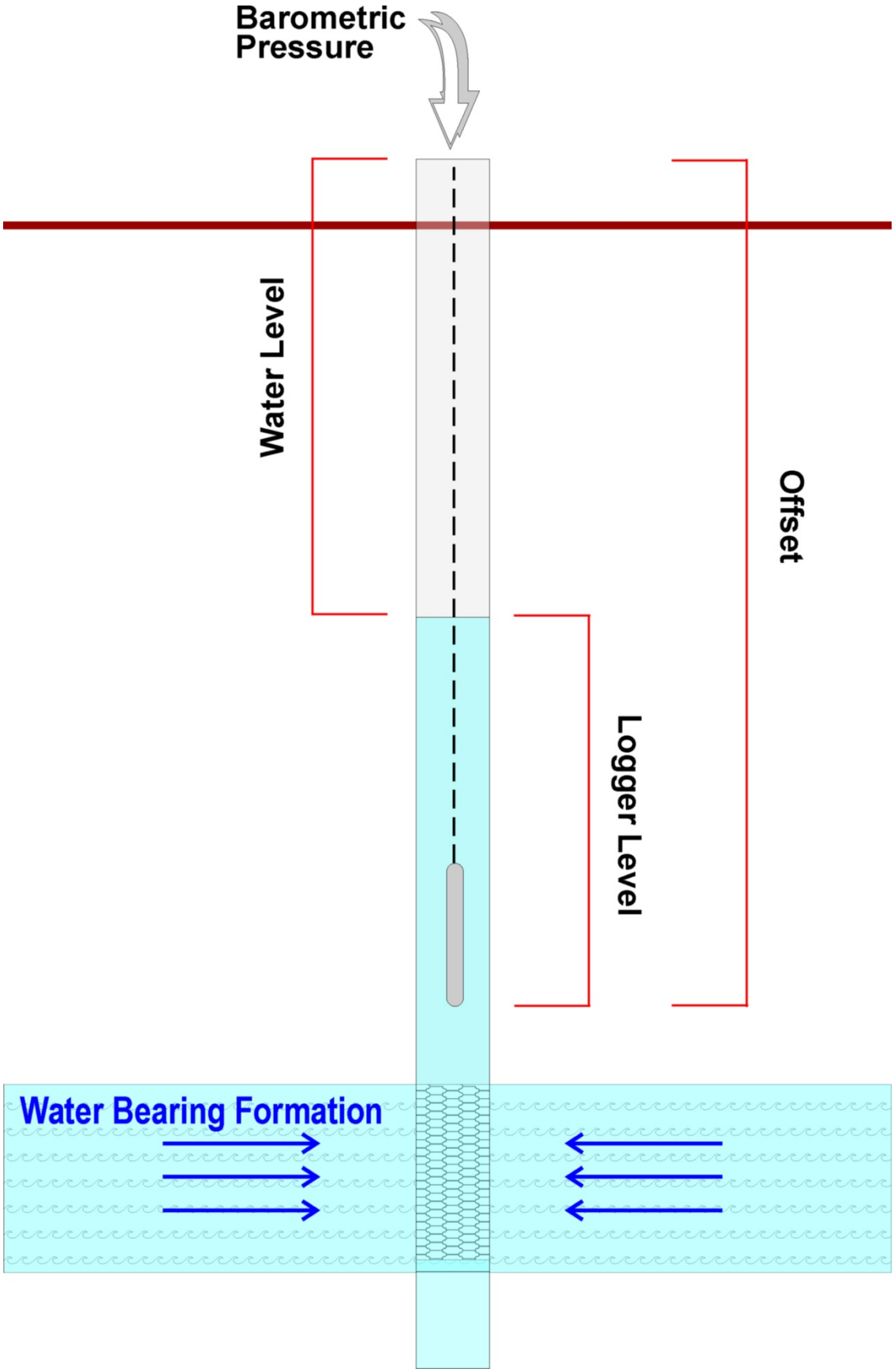
1. Separate the header details from the data. The exported file is a .csv file, a simple spreadsheet file. After editing the .csv you will have to save it as a excel file. The first 22 lines of the spreadsheet are used to express logger settings. Cut these lines out and save them in a new tab so only the data and headers are on the sheet.
2. Create a chart in a new tab. Yes, eventually the data will end up in Mapplet and will automatically generate hydrographs. However, creating hydrographs will allow you to see spikes and single point errors in your data that you can at this point eliminate from your data set if the point is definitely out of a realistic range. It is also nice to see the daily fluctuations of the wells being monitored. When you are done and want to save your file you will need to save it as an Excel workbook. .csv files do not support separate tabs and charts.
3. It's time for the QAQC. Simply take the hard static measurement from when you downloaded the level logger and use the quarterly measurements during the level loggers recording time and

compare those numbers with the results of the level logger from the same general time. The numbers probably won't be exact, but should be within a few hundredths. Consult Solinst manual for error ranges of different level loggers to determine how out of range you are. Then determine if a corrective action should be taken.

4. Lastly put all of the files in the template laid out by the GIS manager. This currently includes the SWN, time, date, and water level BGS for all wells in run on one excel sheet. Also required at this time is a second tab with a bimonthly reading that can be formed with some crafty filtering.

Send the filled out spreadsheet to Data Analyst for the database.

Congratulations, you have completed a transducer download.


Barometric Pressure
Water Level
Offset
Logger Level
Water Bearing Formation